

*OPHIOMASTIX KOEHLERI*, A NEW OPHIOCOMID  
BRITTLESTAR (ECHINODERMATA: OPHIUROIDEA)  
FROM THE WESTERN INDIAN OCEAN

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In 1907, Koehler reported *Ophiocoma wendti* Müller and Troschel from several Indo-West Pacific localities (Fiji Islands; New Ireland; Seychelles; and Fernando Velosa, Mosambique). An illustration said to be of one of the larger specimens was given by Koehler (PL. XIII, Fig. 38) showing an example with several thickened and enlarged (claviform) upper arm spines. The distal ends of some of these spines appear to fork (furcate), a feature known to occur only among members of the genus *Ophiomastix* in the family Ophiocomidae. Furthermore the figure showed the upper arm plates to be mottled with dark and light color, and the arm spines banded.

Attempts to examine the series of specimens reported by Koehler which are deposited in the Muséum National d'Histoire Naturelle, Paris, have not been successful. Dr. G. Cherbonnier informed me (June 1970, pers. comm.) that it was not possible to tell which of the specimens resembled the figure given by Koehler and only a single specimen said to be from Fernando Velosa was sent. That specimen with a disc diameter of 13 mm (smaller than the 20 mm maximum recorded for *O. wendti* by Koehler) proved to be *Ophiomastix palaoensis* Murakami, a species previously known only from Palau in the Western Pacific although also found in the Solomon, Marshall, and Samoan Islands (Devaney, in prep.). It now appears clear that Koehler had more than one species among those he called *Ophiocoma wendti*. It was pointed out in an earlier paper (Devaney, 1970:36-37) that other records of *O. wendti* from the Indo-West Pacific are erroneous, based upon specimens of *O. erinaceus*, *O. occidentalis*, and *O. scolopendrina*, while Müller and Troschel's *O. wendti* was shown to be an Atlantic (West Indian) species known more commonly in the literature as *O. riisei*, a junior synonym.

The subsequent discovery of additional specimens from the Zanzibar region of the western Indian Ocean which fitted the partial description and illustration of *Ophiocoma wendti* by Koehler in 1907 led to my conclusion that a new species was represented (Devaney, 1970:37). The Zanzibar material includes a single specimen reported as *O. wendti* by H. L. Clark (1921) deposited in the Museum of Comparative Zoology, Harvard (MCZ), and 2 other specimens reported and illustrated as *O. wendti* sensu Koehler, 1907 (pt.) by Ailsa M. Clark (in, A. M. Clark and Rowe,

1971) in the British Museum (Natural History) (BMNH). They form the basis of the description which follows of a new species which is considered a member of the genus *Ophiomastix*.

I am most grateful to Miss Ailsa M. Clark, BMNH, for entrusting me with the specimens from that institution, to Dr. H. B. Fell for making the MCZ specimen available and to Dr. G. Cherbonnier for the specimen from the Paris museum.

*Ophiomastix koehleri*, new species

Figures 1-4

*Ophiocoma wendti*: Koehler, 1907 (in part):327-328, Pl. XIII, fig 38. H. L. Clark, 1921:129; 1938:336. Devaney, 1970:35, 37. A. M. Clark and Rowe, 1971:86-87, 91, 118-119 (note), pl. 18, fig. 5 (non *O. wendti* Müller and Troschel, 1842).

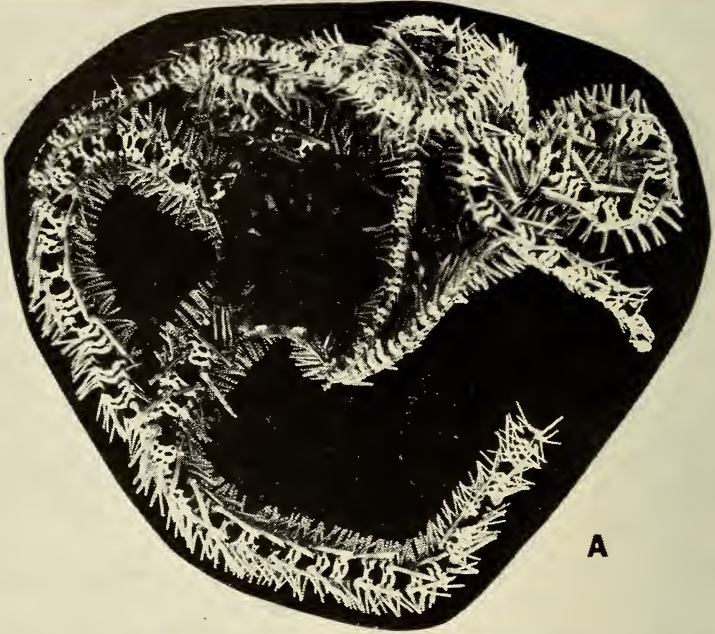
*Ophiomastix asperula* (in part): H. L. Clark, 1915:294; 1921:134 (Zanzibar specimen referred to *Ophiocoma wendti*) [non *O. asperula* Lütken, 1869].

*Etymology*.—This species is named in honor of the French echinodermologist, René Koehler, who first focused attention on it.

*Material examined*.—Three specimens collected from the vicinity of Zanzibar Island, Indian Ocean: (a) One specimen, alcohol, disc diameter (d.d.) 23-25 mm; Zanzibar, no details; origin, Mr. M. Angel (BMNH Reg. No. 1965-6-1-451, holotype). (b) One specimen, alcohol, d.d. 22.5 mm; data same as for holotype (BMNH Reg. No. 1965-6-1-451, paratype). (c) One specimen, dry, d.d. 25 mm; Zanzibar, no data; the specimen discussed by H. L. Clark in 1921 as *Ophiocoma wendti* (MCZ No. 1795, paratype).

*Diagnosis*.—Disc granulated, without spinules. Presence of some modified claviform-furcate upper arm spines. Two tentacle scales regularly only on distal segments. Upper arm plates variegated dark and light, arm spines banded.

*Description of holotype* (BMNH Reg. No. 1965-6-1-451).—d.d. 23-25 mm; arms about 5 times d.d., all broken before tips. Upper surface of disc covered with rounded granules. A random assortment of 25 granules from the disc average 136  $\mu\text{m}$  in diameter (range = 101-177) and 163  $\mu\text{m}$  in height (range = 139-202). In no case is difference between height and diameter of individual granules greater than 50  $\mu\text{m}$ ; in all cases but one (where diameter and height are the same) granule height is greater than its diameter. Granules relatively uniform in distribution, generally not touching each other; radial shields covered by granules; granules continue as broad V-shaped area interradially, becoming sparse near oral shields; 3 or 4 slightly conical granules at distal edges of oral shield; a series of



A



B

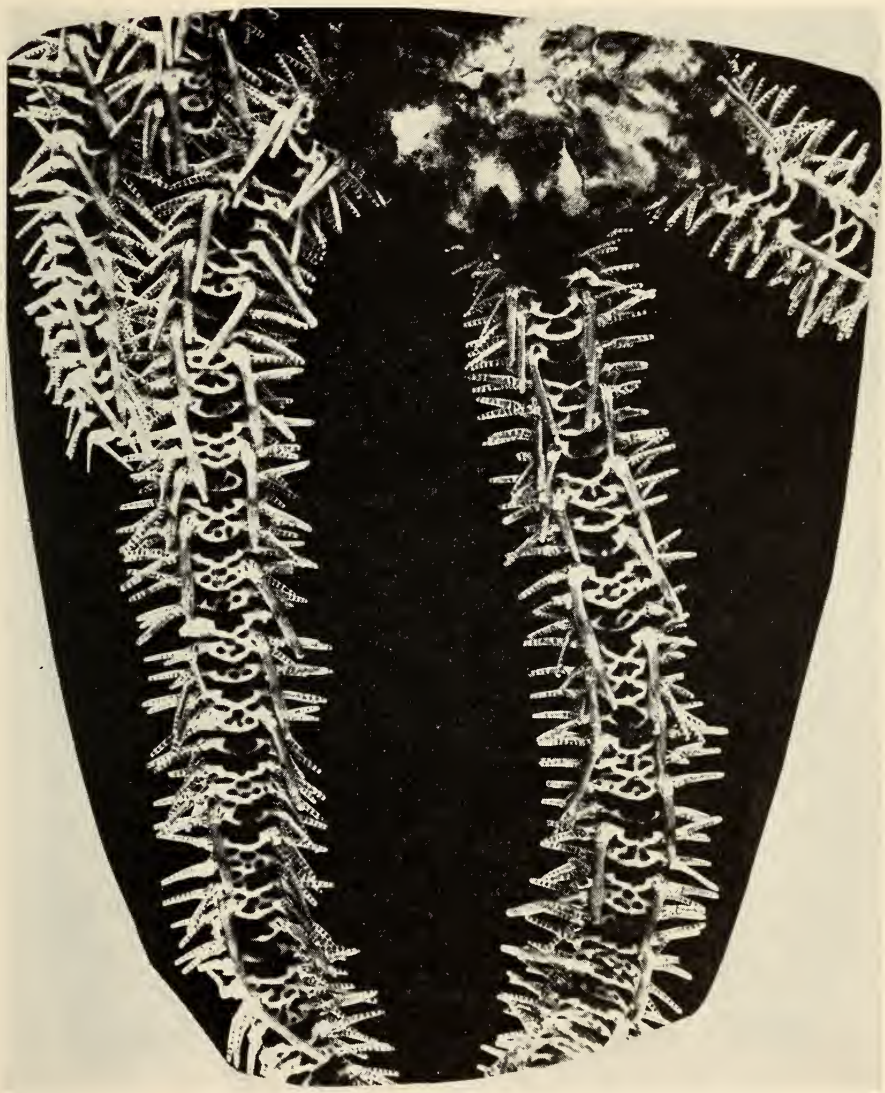


Fig. 2. *Ophiomastix koehleri*, BMNH paratype.

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Fig. 1. *Ophiomastix koehleri*, BMNH holotype: A, Upper surface; B, Lower surface.

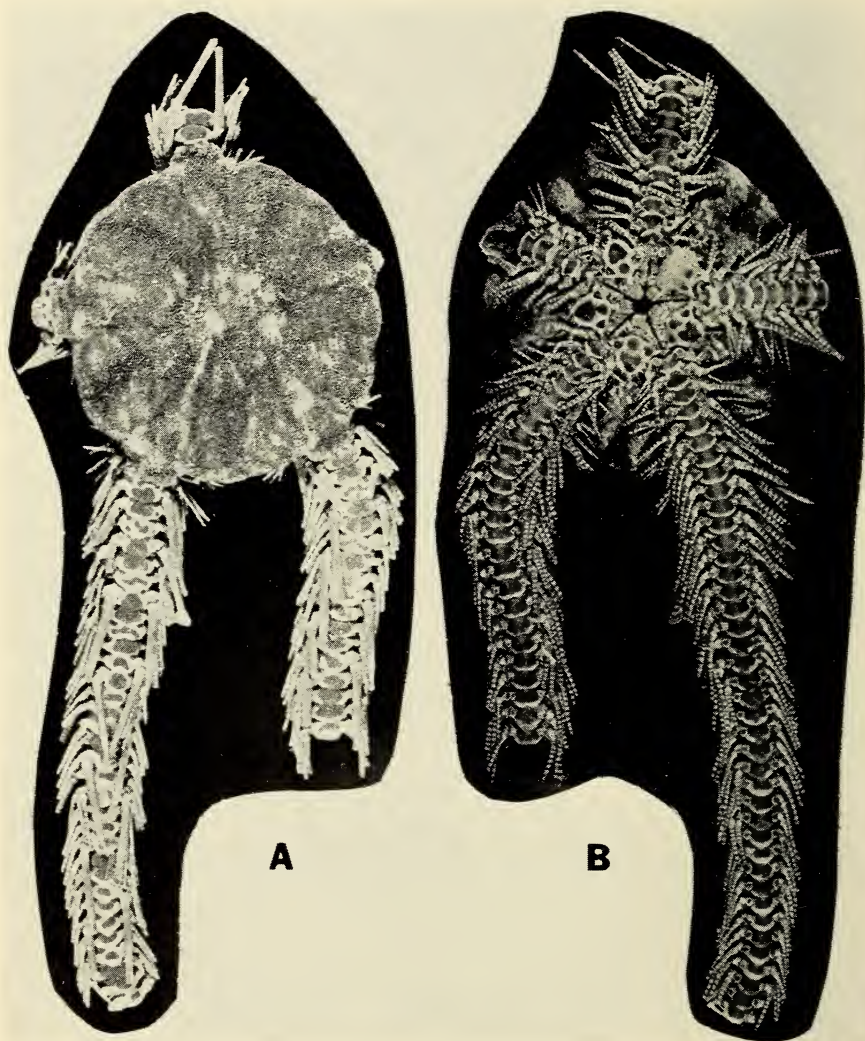


Fig. 3. *Ophiomastix koehleri*, MCZ paratype: A, Upper surface; B, Lower surface.

similar or even more tapering granules along interradial edge of genital opening (these may be in double row part way from oral shield); no evidence of disc spinules.<sup>1</sup>

Oral shield noticeably longer than broad, (1.3:1.0) with greatest breadth distal to middle of shield, only gradually narrowing inward to form straight broad front; madreporite shield wider, with median distal convexity. Adoral shields widely separated within by oral shield; inner radial angle concave

or straight, with buccal tentacle scale only touching near distal part of the angle; outer radial angle touching ventral shield.

Three oral papillae on each side: outer papilla widest with inner side concave; its proximal edge touching adjacent papilla; inner papilla slightly larger than middle papilla, but both inner and middle papillae smaller and not as wide as outer. Buccal tentacle scale contiguous at distal edge with adoral and ventral shields, projecting into mouth slit and partly covered by outer oral papilla. One or 2 subdental papillae at apex of and between oral (jaw) plates.

Thirteen to 15 dental papillae to each jaw, in 3 rows with 3 or 4 irregularly placed papillae deeper. Teeth with wide, blunt hyaline tips.

Lower arm plates near disc to middle of arm broader than long (1.8:1.0) with broadly rounded distal border and tapering distal angles, sometimes slightly concave at mid-distal border;  $\frac{1}{2}$  of total breadth of arm plate separating lateral arm plates at distal border; arm plates becoming more elongate on distal segments.

Upper arm plates with irregular lateral borders where upper arm spines alternate (4 and 3) being truncated where 4th (upper) spine encroaches; upper arm plates with strongly tapering lateral margins and slightly convex median proximal border on segments with 3 spines on each side.

The number of arm spines irregularly alternating beyond disc margin; the sequence for number of arm spines beginning with the first arm segment (beneath the disc) is as follows:

Segment	Part beneath disc						Part beyond disc									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Number of Arm Spines	2	3	3	3	4	4	4	4	4	4	3	4	3	4	3	4
	3	3	3	3	4	4	4	4	4	4	4	3	3	4		
	3	3	3	3	3	4	4	4	4	4	4	4	3	4	3	
	3	3	3	3	4	4	4	4	4	4	4	3	3	4	3	
	3	3	3	3	4	4	4	4	4	5	4	3	3	4	3	3
	3	3	3	3	3	4	4	4	4	4	4	3	4	3	4	3
	3	3	3	3	3	4	4	4	4	4	3	4	3			
	3	3	3	3	3	3	4	4	4	4	4	3	4	4	3	
	3	3	3	3	4	4	4	5	4	3	4	4	3	4		
	3	3	3	3	3	4										

The upper (4th) arm spines on segments beyond disc differ in shape and size from lower spines in same row or from upper (3rd) spine on adjacent or opposite segments (Fig. 4A, B) by being much larger, from 4 to 5 seg-

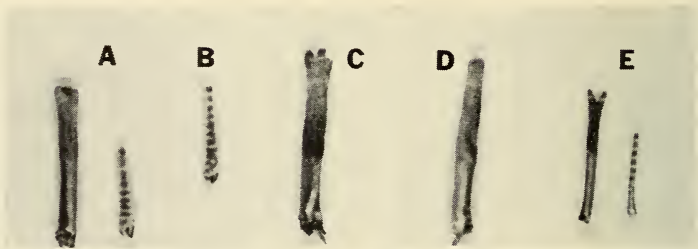


Fig. 4. *Ophiomastix koehleri*, holotype, arm spines: A, 4th (upper) modified spine (left) and 3rd spine (right) from same row on segment 14; B, 3rd (upper) spine from segment 15; C, 4th (upper) spine from segment 24; D, 4th (upper) spine from segment 45; E, 3rd (upper) spine from segment 88 with bifurcate tip (left), and 3rd (upper) unmodified spine from segment 89 (right). A, B, E,  $\times 3.5$ ; C, D,  $\times 4$ .

ments long, usually somewhat swollen in central part then tapering before expanding into a flattened often forked (bi- or tri-lobed) tip (Fig. 4C); from approximately segment 40, there are fewer segments with 4 spines and the 3rd (upper) spines may be enlarged (Fig. 4D) and forked, followed by segments with 3 or 2 spines in a row in which the upper spine is unmodified and located in a lower position on the lateral plate than the modified spine; a modified upper (3rd) spine from segment 88 is compared with an upper (3rd) spine from segment 89 in Figure 4E.

Two tentacle scales on each side of arm segments regularly only on first 8 to 12 segments; increasingly fewer segments with 2 scales and more often only 1 scale on distal segments; where 2 scales occur, outer is larger, but same length as inner scale; where a single scale occurs it is larger than either of the 2 scales and is rounded with a slight taper toward tip, but becomes more tapered on distal segments of arm.

Pigmentation (in alcohol): Basic colors dark blackish brown and white with following pattern: disc above and below uniformly dark brown including granules, except that there is some brown and white color in interradial areas beginning at oral shields; granules upon white areas in interradial region and those along edge of genital apertures also white. Upper arm plates mottled irregularly dark brown and white, rarely is a plate a single color, frequently blotches or bands of dark color predominate, leaving only distal border white. Similar colors on upper side of lateral arm plates. Lower arm plates more regular in pattern with proximal part brown and distal margin white; proximal part of lateral arm plates brown continuing into the brown on lower arm plates. Tentacle scales brown and white, brown in 2 or 3 irregular bands across scales with edges white. Arm

spines, except for enlarged upper ones, distinctly banded brown and white with brown rings slightly wider than white rings; many of the spines with tips white; upper modified spines more uniform in color, light brown but with some annulation toward the tips. Mouth region showing considerable brown color especially oral shields with only their outer margins white; a part of each adoral plate brown, as well as parts of oral papillae and inner edge of oral plates. (A part of the disc and arms of the holotype is shown as Plate 18, figure 5 by A. M. Clark and Rowe, 1971.)

### Comparison with Other Specimens and Variations

A. *Disc cover*.—BMNH paratype (d.d. 22.5 mm) similar to holotype in distribution of granules, but with only 1 or 2 granules at base of oral shield. A random assortment of 25 granules was examined: the granules averaged 124  $\mu\text{m}$  (89–139) in breadth and 117  $\mu\text{m}$  in height (101–139). In contrast to the holotype the granules were generally slightly broader than high or equal in height and diameter, the ratio never exceeding 1.0:1.4. The MCZ paratype (d.d. 25 mm) is similar to the holotype.

B. *Tentacle scales*.—BMNH paratype with 2 scales regularly on each side to segments 12, 11, 8, 9, 13; with 1 scale becoming more frequent on distal segments. MCZ paratype with 2 scales regularly on each side to segment 15, 11, irregularly to segment 25 and on more distal segments 2 scales widely spaced, otherwise 1 scale.

C. *Arm spine sequence*.—BMNH Paratype:

Segment	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Number of Arm Spines	3	3	3	3	3	4	4	4	4	4	4	3	4	3	4
	3	3	3	3	3	4	4	4	4	4	4	3	4	3	3
	3	3	3	3	4	4	4	4	4	4	4	3	4	3	4
	3	3	3	3	3	4	4	4	4	4	4	4	4	3	4
	3	3	3	3	4	4	4								
	3	3	3	3	4	4	4								
	3	3	3	3	3	4									
	3	3	3	3	3	4									
MCZ Paratype	3	3	3	3	4	4	5	4	4	3					
	3	3	3	3	4	4	4	4	4	4					



Segment	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Number															
of	3	3	3	3	4	4	4	4							
Arm	3	3	3	3	4	4	3	4							
Spines															
	3	3	3	4	4	4	4	4	4	4	4	4	4	3	
	3	3	3	3	4										
	3	3	3	3	4	4									
	3	3	3	3	4										
	3	3	3	3	4										
	3	3	3	3	4										

Comparing these arm spine sequences with that of the holotype one notes that all but one side of the first 4 arm segments carry 3 arm spines and the 5th segment carries 3 and/or 4. The presence of 5 arm spines on any side of an arm segment is rare but may occur between segments 7 and 10. The irregular alternation of 3 and 4 arm spines usually is evident from segment 10.

The MCZ specimen shows modified enlarged upper arm spines from segments 9 to 51 on one ray examined. These modified spines occur on opposite sides of segments 9 and 10, both sides of segments 12, 14, and 17, then on one side of segments 20, 21, 24, and 25. Farther out on arm they occur on every 2 to 4 segments. Some spines are distinctly forked at tip while others are only flattened at tip and somewhat swollen in middle of spine. Some spines reach up to 6 segments in length.

Two arm spines were noted on a few segments beyond segment 20, being most evident past segment 40. Segments beyond 40 also showed the 3rd (upper) spine in a row enlarged and elongate; from this part of the arm to the end, the presence of 4 arm spines is infrequent and 3 spines are more common.

In the same row on a segment side, the lowest spine is usually as long as, or somewhat longer than, the next spine and is slightly curved.

*D. Pigmentation.*—BMNH paratype with aboral surface of disc brown where granules are present; underlying scales lighter; granular area over radial shields lighter brown in a narrow band. Lower arm plates, beyond segment 10, having dark brown color in 2 lateral bands with center light except for small dark spot near distal border; sometimes central part of plate also dark. Tentacle scales with several dark spots. Mouth shields with several brown blotches; adoral shields with medial brown spot. Inter-radial part of disc, from oral shield out to granular area, with light and dark scales, some of the granules white. Some upper arm plates have brown color in blotches, but otherwise as described for holotype, with majority having the distal edge white. Arm spines not completely banded, rather

with alternating bands of brown and white on upper and lower sides but interrupted with light line along lateral edges.

The MCZ paratype is quite similar to the holotype in color.

### Relationships

The new species, *Ophiomastix koehleri*, strongly links *Ophiomastix* with the Scolopendrina group of *Ophiocoma*. Both Koehler (1907) and H. L. Clark (1921) rightly considered that this form as *Ophiocoma wendti* combined characters of both genera.

The low, rounded, non-contiguous granules, absence of disc spinules, and alternation of arm spines present in *Ophiomastix koehleri* are characteristic of the Scolopendrina group of *Ophiocoma* (Devaney, 1970). However, the latter is also a feature of *Ophiomastix*, while the presence of enlarged upper arm spines, with the tips forked is known only among species of *Ophiomastix* and is the criterion which leads me to place this new species in this genus. Of those species of *Ophiomastix* possessing disc granules, only *O. asperula* Lütken has these more abundant than spinules. However, the granules of *O. asperula* are conical and not bluntly rounded as in *O. koehleri*.

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### Footnote

<sup>1</sup>Granules are herein defined as elements whose height is 2 times or less than their diameter or greatest breadth; spinules as elements whose height exceeds twice the maximum diameter or greatest breadth.